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National Safety Council

Teaching of safety in technical schools and...

Chicago

1918

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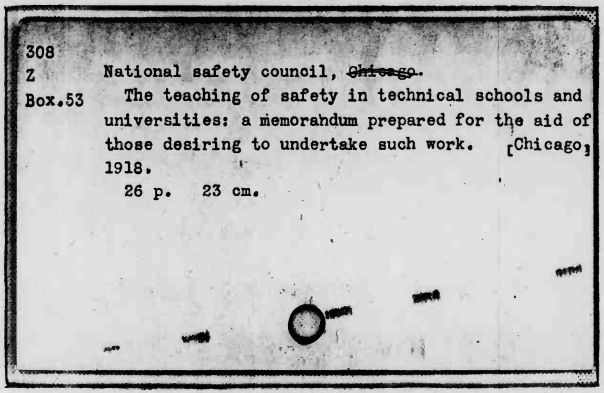

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National safety council, ~~Chicago~~.
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The Teaching of Safety in Technical Schools and Universities

A Memorandum Prepared for the Aid of Those Desiring to Undertake Such Work

NATIONAL SAFETY COUNCIL
June, 1918

The address of the National Safety Council is
Continental and Commercial Bank Building
Chicago, Ill.
The General Manager is Mr. W. H. Cameron

The address of the American Museum of Safety is
14 West 24th Street
New York City
The Director is Mr. A. H. Young

INTRODUCTION

The purpose of this pamphlet may best be stated by explaining the situation that has led up to its publication. The National Safety Council in its desire to attack the safety problem in the most fundamental way created last year a Committee on the Promotion of Safety Education in Technical Schools and Universities. At the same time it was found that the American Museum of Safety had planned a campaign along much the same lines. In order to centralize the movement, the American Museum of Safety generously offered to merge its own activities in this field with those of the National Safety Council.

The Committee found a great latent interest among universities. This was brought into tangible form by meetings of the eastern and western universities held respectively at New York on March 2 and at Chicago on March 20. Committees were appointed at both the eastern and western conferences to cooperate with the original committee.

As an outgrowth of these meetings a session on Safety Education was arranged as part of the program of the American Society of Mechanical Engineers, at its meeting at Worcester, Massachusetts, on June 5; in connection with this there is also to be a meeting of the three committees.

As a matter of information and reference the membership of the Committees is herewith given.

Committee of the National Safety Council:

Dexter S. Kimball, Dean of Sibley College, Cornell University.
Arthur H. Young, Director, American Museum of Safety.
S. B. McCormick, Chancellor, University of Pittsburgh.
C. P. Tolman, Chairman Manufacturing Committee, National Lead Company.
Albert W. Whitney, General Manager, National Workmen's Compensation Service Bureau, Chairman.

Committee of Eastern Universities:

Dexter S. Kimball, Dean of Sibley College, Cornell University, Chairman.
Professor George H. Follows, Carnegie Institute of Technology.
Professor A. S. Kinsey, Superintendent of Shops, Stevens Institute of Technology.
Professor F. P. McKibben, Lehigh University.
Professor G. F. Blessing, Swarthmore College.

Committee of Western Universities:

C. H. Benjamin, Dean of Schools of Engineering, Purdue University, Chairman.
Professor John T. Faig, University of Cincinnati.
Professor J. A. Polson, Michigan Agricultural College.
Professor J. C. Roberts, Colorado School of Mines.
Professor F. H. Sibley, University of Kansas.

This pamphlet is published for distribution, primarily in connection with the Worcester meeting, for the use of universities and technical schools having the inclination but not the experience to undertake work in safety.

Before entering upon the detail of this matter, a few words should be said with regard to the safety problem and the part that the universities should take in its solution.

The toll of lives and limbs taken by accidents in this country is enormous. In the field of industry alone the deaths in the United States due to accident are approximately 22,000 a year with a record of at least 400,000 serious injuries other than death. With the great development in the use of automobiles and with the increasing congestion in cities the problem of public safety is also becoming extremely serious.

An awakening with regard to the industrial accident situation came coincidentally with the introduction of workmen's compensation into this country and partly because of it; the primary motive, however, was humanitarian. The movement in the field of public safety is only now in its infancy. In both fields, however, although effective work has been done, it has only scratched the surface. The present movement is an attempt to get below the surface.

The safety problem is fundamentally psychological. What needs most to be done is to make men *think in terms of safety*. Just as the war is introducing the idea of thrift into the nation so the idea of thrift in the saving of lives and limbs must be learned. Safety must take its place in the consciousness of people as part of the program of conservation, and conservation as part of the program of efficiency.

In no way can this result be produced in industry more effectively than by education of the coming generation of engineers. The coming engineer must have as part of his point of view an appreciation of the fact that the work and the life of the world must go on under right conditions, not merely conditions that will produce the highest mechanical efficiency, but conditions that will produce the highest human and spiritual efficiency; he must design machines that will not only do their work but that will do their work without killing and maiming. He must come to this point of view not only from the side of humanity but from the side of efficiency as well.

Coincidentally with the entrance of this country into the war the arsenals and navy yards (through the assistance of the National Safety Council and the American Museum of Safety), and later the United States Shipping Board, were put upon a safety basis with well-developed safety organizations. This was not done primarily for humanitarian reasons; it was done for efficiency. It meant a saving in money, greater production, fewer wasted lives.

This seems at first sight a bad time to try and introduce safety into the university curriculum, when the universities are pressed to the limit to perform the tasks that are already before them; so it is, from the standpoint of sentiment alone, but from the standpoint of efficiency there never has been a time when it was so imperative. If to win the war it is important that we should save wheat, it is doubly important that we should save lives.

In what follows the attempt has been made to mobilize the resources that are at the disposal of the universities.

I. SUGGESTIONS AS TO THE INCORPORATION OF SAFETY EDUCATION IN ENGINEERING CURRICULA

For the sake of sincerity and consistency, if a university is to take up the teaching of safety, it should first, or at least coincidentally, make sure that its own shops and equipment are in right condition. This needs no argument. Later on in this pamphlet this matter is referred to again and suggestions made with regard to getting this work done.

Safety education for the engineer is of two types; first, safety education for the engineer in general, whatever may be his field, and second, safety education for those who are to enter the field of Safety Engineering. Of these the former is the more important and yet the demand and opportunities for trained specialists in safety is becoming very great.

Several points at which safety education may advantageously be introduced into the curriculum are evident. Many universities give during the freshman or sophomore years an inspirational course in the problems of engineering designed to give the student a glimpse of the field that is before him. It is evident that the opportunity should not be lost to call attention in such a course, specifically and recurrently, to the importance of conserving life and limb, as part of the problem of efficiency.

A course is now common in the senior year on industrial management, in fact in some universities the curriculum is so designed as to make a special way for those who expect to go into the administrative side of manufacturing or other engineering business. This is *par excellence* the place for the introduction of the idea of safety as an element in efficiency.

Safety in a factory is likely to be put under the general supervision of a junior executive, such as the assistant to the president; safety work is often combined with work in connection with employment, sanitation, etc. The one who holds a position of this kind should be thoroughly possessed of the importance of these human elements in contributing to the sum total of plant efficiency.

It is evident that there should be detailed safety work in connection with such courses as machine design, building construction, electric installation and mining. Such courses require work of a highly technical character. The plans of the National Safety Council contemplate the preparation of syllabi or other aids in the prosecution of this work; these will be referred to later in this memorandum.

Some universities at this time and doubtless many later will desire to adapt their instruction to specific technical training for the field of Safety Engineering. This is already an important field and will be increasingly so in the future. The claim of this work upon the universities is set forth in a paper by Mr. L. A. DeBlois of E. I. duPont de Nemours & Company, presented at the Worcester meeting of the American Society of Mechanical Engineers and because of its apposite character, included herein. It is impossible on this occasion to present any detailed suggestions as to how such work can best be carried on. This is a matter, however, that the Committee has under advisement and something will be published on it later.

As a matter of record there is given herewith the report adopted by the Committee has under advisement and something will be published on it in New York on March 2, 1918.

REPORT BY THE COMMITTEE OF EASTERN UNIVERSITIES

(1) We are greatly impressed with the importance of the safety movement and approve most heartily of all efforts that can be made to awaken an interest in this matter. We believe furthermore that it is the duty of all engineering colleges to do what they can to forward this important work.

(2) We believe that no permanent work can be done by the engineering colleges in this direction without active interest and work on the part of the members of their faculties. It is not sufficient to express approval of the movement.

(3) We would recommend that the National Safety Council prepare a list of topics on safety work and a list of lecturers on this subject that may be available for the use of technical colleges.

(4) We would recommend further that engineering colleges select not more than three of these topics to be given at such times as may seem desirable during the coming year. It is our understanding that the National Safety Council will send these lecturers free of charge to such colleges as may desire this service.

(5) We recommend also that the attention of educators be called to the collection of slides, moving picture reels, exhibits, literature and bibliographies in the possession of the National Safety Council and the American Museum of Safety which can be put at the disposal of educators throughout the country. It is felt that many teachers may wish to build up this line of work to suit their particular circumstances, and these collections can be made of great service to such teachers.

(6) We would recommend that after such initial steps as have been suggested in the foregoing have been taken, courses in safety work be incorporated in the curriculum of all engineering colleges so far as this may be possible under existing conditions.

(7) In this connection also we would recommend that college shops and laboratories should first be made safe. To assist in securing this result, we would suggest that state inspectors be invited to inspect college shops and laboratories as a means of calling to the attention of the faculty such glaring defects as may exist and which would not be permitted in commercial work. An inspection of this kind would undoubtedly give safety work an impetus in many institutions. Mr. Whitney, Chairman of the Safety Education Committee, has offered to secure the aid of the state inspectors of the various insurance companies that are members of the National Workmen's Compensation Service Bureau. Since these are scattered over a considerable territory, it would seem as though they might be very helpful in this work.

II. SAFETY LECTURES

At the Conference in New York it was suggested that a list of subjects for safety lectures be prepared with the understanding that the National Safety Council would furnish speakers on these various subjects for universities that might desire to hold such lectures. It was also recommended that each university should during the school year provide for three or four

of these lectures by outside speakers, in the belief that the inspiration was needed of contact with those who could speak with authority of things actually accomplished.

A list of eighteen subjects is included herewith. These are of a general nature and such as will prove of interest to a student audience. Technical questions have been avoided. Under each subject is included a list of speakers who have volunteered to be on call for the delivery of a limited number of such lectures at universities and colleges.

It is requested that all arrangements for lectures be made through the General Manager of the National Safety Council and not directly with the speakers, particularly since assignments must be made largely on a geographical basis, such as will accord with the convenience of the speakers; in many cases other speakers not already on this list will have to be appealed to and it is obvious that the National Safety Council is best able to make the necessary arrangements.

In all cases it will be understood that the speakers volunteer their services free with the understanding however that all expenses are to be paid by universities unless otherwise explicitly arranged.

LIST OF SUBJECTS AND SPEAKERS

1. INDUSTRIAL CASUALTIES IN THE UNITED STATES
   - LUCIAN W. CHANEY, Statistician, Bureau of Labor Statistics, Washington, D. C.
   - L. W. HATCH, Chief Statistician, New York State Department of Labor, Albany.
   - FREDERICK L. HOFFMAN, Third Vice President and Statistician, Prudential Insurance Company of America, Newark.
   - HON. ROYAL MEEKER, Commissioner of Labor Statistics, Washington, D. C.
   - E. B. SAUNDERS, Secretary, New England Safety Council, Fitchburg, Mass.

2. HISTORY, GROWTH AND SCOPE OF THE SAFETY MOVEMENT
   - JOHN R. BROWNELL, Superintendent of Safety, Industrial Accident Commission, San Francisco.
   - W. H. CAMERON, General Manager, National Safety Council, Chicago.
   - MARCUS A. DOW, General Safety Agent, New York Central Lines, New York City.
   - GEORGE F. HAYDON, General Manager, Wisconsin Compensation Rating and Inspection Bureau, Milwaukee.
   - DAVID VAN SCHAACK, Director, Bureau of Inspection and Accident Prevention, Aetna Life Insurance Company, Hartford.

3. OUTLINE OF ORGANIZATION FOR ACCIDENT PREVENTION WORK IN INDUSTRIES
   - S. W. ASHE, Education Department, General Electric Company, Pittsfield, Mass.
   - L. H. BURNETT, Assistant to President, Carnegie Steel Company, Pittsburgh.
   - ROBERT W. CAMPBELL, Chairman Safety Committee, Illinois Steel Company, Chicago.

J. P. EIB, Supervisor of Safety and Labor, Illinois Steel Company, Joliet, Ill.
A. S. REGULA, Safety Engineer, United States Navy Yard, New York.
H. A. SCHULTZ, Safety Engineer, United States Shipping Board, Philadelphia.
R. J. YOUNG, Manager Department of Safety and Relief, Illinois Steel Company, Chicago.

4. SAFETY ENGINEERING AS APPLIED TO PLANS AND SPECIFICATIONS FOR BUILDINGS

H. W. FORSTER, General Manager, Independence Inspection Bureau, Philadelphia.
A. D. RISTEEN, Director of Technical Research, Travelers Insurance Company, Hartford.
H. A. SCHULTZ, Safety Engineer, United States Shipping Board, Philadelphia.
SIDNEY J. WILLIAMS, Superintendent, Accident Prevention Department, National Safety Council, Chicago.

5. SAFETY FEATURES TO BE INCLUDED IN SPECIFICATIONS FOR MECHANICAL EQUIPMENT

DAVID S. BEYER, Vice President, Liberty Mutual Insurance Company, Boston.
A. B. COLE, Manager Bureau of Safety, Utica Mutual Compensation Insurance Corporation, Utica.
EARL B. MORGAN, Chief Safety Engineer, Liberty Mutual Insurance Company, Boston.
C. P. TOLMAN, Chairman Manufacturing Committee, National Lead Company, New York City.
SIDNEY J. WILLIAMS, Superintendent Accident Prevention Department, National Safety Council, Chicago.

6. INCULCATION OF HABITS OF CAUTION IN WORKMEN

H. B. ADAMS, Safety Supervisor, The Aurora, Elgin and Chicago Railroad Company, Aurora, Ill.
M. E. ARKILLS, Safety Engineer, Pullman Company, Pullman, Ill.
ROBERT W. CAMPBELL, Chairman, Central Safety Committee, Illinois Steel Company, Chicago.
L. A. DEBLOIS, Chief Safety Engineer, E. I. duPont de Nemours & Company, Wilmington.
J. P. EIB, Supervisor of Safety and Labor, Illinois Steel Company, Joliet, Ill.
ARTHUR T. MOREY, General Manager, Commonwealth Steel Company, St. Louis.
C. W. PRICE, Field Secretary, National Safety Council, Chicago.

7. THE PRINCIPLES OF MECHANICAL SAFEGUARDING

W. P. EALES, Assistant Superintendent, Engineering and Inspection Division, Travelers Insurance Company, Hartford.
H. GUILBERT, Manager, Safety Department, Haskell & Barker, Inc., Michigan City.

GEO. F. HAYDON, General Manager, Wisconsin Compensation Rating and Inspection Bureau, Milwaukee.
HAROLD MESTRE, Consulting Engineer, San Francisco.
SIDNEY J. WILLIAMS, Superintendent, Accident Prevention Department, National Safety Council, Chicago.
R. J. YOUNG, Manager, Department of Safety and Relief, Illinois Steel Company, Chicago.

8. THE PRINCIPLES OF SAFETY IN ELECTRICAL TRADES.

S. W. ASHE, Educational Department, General Electric Company, Pittsfield, Mass.
H. L. GANNETT, Safety Inspector, Commonwealth Edison Company, Chicago.
M. G. LLOYD, Electrical Engineer, Bureau of Standards, Washington, D. C.
DANA PIERCE, Vice President, Underwriters' Laboratories, New York City.
W. P. STRICKLAND, New York & Queens Electric Light & Power Company, Long Island City.

9. THE CONTROL OF NOXIOUS DUSTS AND FUMES

C. A. BOOTH, Sales Manager, Buffalo Forge Company, Buffalo.
JAMES B. DOUGLAS, Manager Claim Department, United Gas Improvement Company, Philadelphia.
F. R. ELLIS, Sturtevant Company, Boston.
M. W. FRANKLIN, Consulting Engineer, E. F. Houghton Company, Philadelphia.
DR. E. V. HILL, Inspector in Charge of Division of Ventilation, Department of Health, Chicago.
FREDERICK L. HOFFMAN, Third Vice President and Statistician, Prudential Insurance Company of America, Newark.
D. D. KIMBALL, Richard D. Kimball Company, New York City.
A. D. RISTEEN, Director of Technical Research, Travelers Insurance Company, Hartford.
JOHN ROACH, Chief Bureau of Hygiene and Sanitation, Department of Labor, Trenton.
F. R. STILL, America Blower Company, Detroit.
C. P. TOLMAN, Chairman Manufacturing Committee, National Lead Company, New York City.

10. SHOP HYGIENE AND SANITATION

DR. J. C. BLOODGOOD, Medical Department, Johns Hopkins University, Baltimore.
MISS LILLIAN ERSKINE, Department of Labor, Trenton.
DR. W. A. EVANS, Health Department, Chicago Tribune, Chicago.
DR. L. K. FRANKEL, Third Vice President, Metropolitan Life Insurance Company, New York City.
DR. E. R. HAYHURST, College of Medicine, Ohio State University, Columbus.
HON. ROYAL MEEKER, Commissioner of Labor Statistics, Washington, D. C.
DR. L. A. SHOUDY, Chief Surgeon, Bethlehem Steel Company, South Bethlehem, Pa.

11. FELLOWSHIP (INDUSTRIAL BETTERMENT ACTIVITIES)

J. M. EATON, Assistant to the President, Lincoln Motor Company, Detroit.
ARTHUR T. MOREY, General Manager, Commonwealth Steel Company, St. Louis.
C. A. PROSSER, Director, Federal Board for Vocational Education.
DAVID VAN SCHAACK, Director, Bureau of Inspection and Accident Prevention, Aetna Life Insurance Company, Hartford.
A. H. YOUNG, Director, American Museum of Safety, New York City.

12. FUNCTIONS OF AN INDUSTRIAL SURGEON.

DR. J. C. BLOODGOOD, Medical Department, Johns Hopkins University, Baltimore.
LT. COLONEL L. H. CONNER, Medical Corps, United States Army, Washington, D. C.
DR. THOMAS R. CROWDER, Director, Department of Sanitation and Surgery, The Pullman Company, Chicago.
DR. F. E. SCHUBMEHL, Works Physician, General Electric Company, West Lynn, Mass.
DR. L. A. SHOUDY, Chief Surgeon, Bethlehem Steel Company, South Bethlehem.

13. ACCIDENT PREVENTION ON AMERICAN RAILROADS

H. W. BELNAP, Manager Safety Section, Division of Transportation, United States Railroad Administration, Washington, D. C.
MARCUS A. DOW, General Safety Agent, New York Central Lines, New York City.
ISAIAH HALE, Safety Supervisor, Atchison, Topeka & Santa Fe Railway, Topeka.
RALPH C. RICHARDS, General Counsel, Chicago & Northwestern Railway, Chicago.
W. C. WILSON, Assistant Director, American Museum of Safety, New York City.

14. SAFETY IN MINES AND MINING

H. G. DAVIS, Lehigh & Wilkes-Barre Coal Company, Wilkes-Barre, Pa.
ALBERT H. FAY, United States Bureau of Mines, Washington, D. C.
R. DAWSON HALL, Associate Editor, Coal Age, New York City.
D. J. PARKER, United States Bureau of Mines, Washington, D. C.
PROFESSOR J. C. ROBERTS, Department of Safety and Efficiency Engineering, Colorado School of Mines, Golden.
B. F. TILLSON, Superintendent, New Jersey Zinc Company, Franklin, N. J.
H. M. WILSON, Director of Department of Inspection and Safety, The Associated Companies, Pittsburgh.

15. FIRE PREVENTION

DANA PIERCE, Vice-President, Underwriters' Laboratories, New York City.
M. J. T. STEWART, New York Board of Fire Underwriters, New York City.

FRANKLIN H. WENTWORTH, Secretary, National Fire Protection Association, Boston.
SIDNEY J. WILLIAMS, Superintendent Accident Prevention Department, National Safety Council, Chicago.

16. SAFETY AND ALLIED ACTIVITIES—THEIR VALUE AS AN INVESTMENT AND AS A DETAIL OF EFFICIENT ORGANIZATION

H. W. FORSTER, General Manager, Independence Inspection Bureau, Philadelphia.
D. R. KENNEDY, Industrial Relations Manager, American International Shipbuilding Corporation, Hog Island.
HAROLD MESTRE, Consulting Engineer, San Francisco.
C. W. PRICE, Field Secretary, National Safety Council, Chicago.
A. H. YOUNG, Director, American Museum of Safety, New York City.

17. WHAT A STUDENT ENGINEER SHOULD LEARN ABOUT SAFETY

DAVID S. BEYER, Vice-President, Liberty Mutual Insurance Company, Boston.
D. R. KENNEDY, Industrial Relations Manager, American International Shipbuilding Corporation, Hog Island.
EARL B. MORGAN, Chief Safety Engineer, Liberty Mutual Insurance Company, Boston.
SIDNEY J. WILLIAMS, Superintendent, Accident Prevention Department, National Safety Council.

18. OCCUPATIONAL DISEASES

DR. ALICE HAMILTON, United States Department of Labor, Washington D. C.
DR. GEORGE H. KOBER, Dean School of Medicine, Georgetown University, Washington, D. C.
PUBLIC HEALTH SERVICE, UNITED STATES GOVERNMENT.
N. B.—The Public Health Service will detail a specialist to lecture on Occupational Diseases in any university following the general plans of the Safety Education Committee.
DR. JOHN W. TRASK, Surgeon U. S. Public Health Service, Washington, D. C.

III. EXHIBITS

A large amount of material can now be furnished by or through the American Museum of Safety and the National Safety Council for use in connection with lectures and courses on safety. This consists of working models, bulletins, photographs, drawings, lantern slides, films, etc.

The list of material available is as follows:

FROM THE NATIONAL SAFETY COUNCIL

Safety Bulletins.

The Council has prepared a number of sets of cards, measuring 24 x 36 inches, and bound with black cloth, upon which have been

mounted sample copies of its publications, including the various series of Safety Bulletins.

These Bulletins will illustrate concretely the causes of accidents due to the absence of safeguards and those caused by lack of care on the part of workmen. The "Service Series" provide information for the management and engineers of the industries and describe methods of securing reductions in accidents.

Moving Picture Films.

Safety motion picture films play an important part in accident prevention work. The Council lends films dealing with industrial safety, public safety, gas and electrical safety, railroad safety, alcohol, fire prevention, and such topics as first aid, welfare, and similar subjects. Except in certain special cases, there is no charge for the use of these films other than payment of express charges.

The Council will gladly furnish on request a pamphlet, "Motion Picture Films," fully describing the reels.

Lantern Slides.

The collection of lantern slides maintained by the Council deals with many aspects of the safety problem. Sets of these slides, suited to specific requirements, will be lent on request, by payment of transportation charges. One important set of 50 slides, together with a mimeographed lecture, is entitled, "The National Safety Movement," and deals in logical sequence with every aspect of the accident prevention work.

FROM THE AMERICAN MUSEUM OF SAFETY

Safeguards and Safe Practices, experience of Bureau of Inspection and Accident Prevention, Aetna Life Insurance Company, Hartford, Conn.

Multiplex display racks containing 32 double-faced wings or frames upon which are mounted approximately 500 photographs, illustrating standard safeguards and safe practices in cotton mills, foundries, tanneries, engine and boiler houses, metal-working, paper cutting, printing, wood-working, and miscellaneous operations.

Model Engine Room (loaned to the Museum by the Bureau of Inspection and Accident Prevention, Aetna Life Insurance Company).

This model, mounted on a table and electrically operated, illustrates the proper guarding of the engine, switchboard, motor, jack-shaft, pulleys, belting, fly-wheel, governor fly-balls and other parts to be found in a completely equipped engine room.

Model Factory (loaned to the Museum by the Bureau of Inspection and Accident Prevention, Aetna Life Insurance Company).

This model represents a mill building of brick construction, built on a scale of one inch to a foot. It is divided into two equal sections by a firewall through the roof. This makes two factories, each two

stories in height, illustrating and contrasting model working conditions with those that are unsafe and unsanitary.

Each factory represents a general jobbing shop, the upper floor showing a woodworking department and the lower, a metal-working department. All of the little machines in the two departments are exact reproductions of the larger tools to be found in modern factories and workshops.

Sanitary Standards for Felt Hatting Trades.

This exhibit was prepared for the Museum by the Division of Hygiene and Sanitation, New Jersey Department of Labor. A display rack containing photographs with appropriate text describing health hazards peculiar to the felt hat making industry, as well as approved designs for the removal of dangerous dust, fumes, steam and excessive heat.

Industrial Dust and Fume Removal.

Prepared by the Division of Hygiene and Sanitation, New Jersey Department of Labor.

A display rack upon which are mounted photographs of actual working conditions, blue prints, and text describing standard systems for the removal of dusts incidental to woodworking, foundry work, buffing, grinding and polishing operations, and the boot and shoe trade; fumes in metal-working and printing operations, heat and steam in laundries, etc.

Safety in Railroad Operation.

Display rack of eight double-frames upon which are mounted photographs and statistical diagrams, illustrating common causes of accidents and contrasting safe and unsafe practices in railroad operation. From the experience of the Chicago and North Western Railway company.

Safety, Sanitation and Welfare in the Smelting Industry.

A display rack of ten double-frames containing photographs and blue prints illustrating installations of safety devices, provisions for shop sanitation and health conservation; also facilities for recreation, education, and general welfare of employees and their families. Experience of the New Jersey Zinc Company.

Accident Prevention Work of the United States Steel Corporation.

Display rack of twelve double-frames, containing photographs illustrating plan of safety organization, safety education, and standard safeguards for blast furnaces, machine shops, cranes, mills, engine and boiler rooms, mines, and transportation systems.

Safety Standards of the National Workmen's Compensation Service Bureau.

Twenty-two double-frames upon which are mounted original diagrammatic drawings, used in illustrating the first volume of "Universal Safety Standards," and showing the principles approved by the Bureau for safeguarding dangerous machines and conditions most frequently found in machine shops and foundries, as well as the ordinary hazards common to all industries.

Gary Hospital, Indiana Steel Company.

Cabinet (closed type) of fifteen wing frames upon which are mounted photographs of building and equipment of the Indiana Steel Company (United States Steel Corporation Subsidiary) at Gary, Indiana.

Rack of Safe and Unsafe Tools.

Prepared by the Norfolk and Western Railway.

This exhibit contrasts dangerous "burred" tools with tools which have been reforged and made safe for use of workers.

Safety in Copper Mining.

Five frames of mounted photographs, illustrating safe and unsafe practices and safety appliances installed by the Anaconda Copper Mining Company, Butte, Montana; one panel of safety bulletins for education of workers in this plant.

Protective Work Garments.

Selected exhibit of heat-resisting and other protective garments, including coat, trousers, leggings, spats, gloves and mittens; also "Congress" shoes for foundry workers; stout shoes for general shop work and insulating overshoes for linemen and other workers exposed to high tension apparatus.

Non-Explosive Cans and Containers.

"McNutt" safety cans and containers for volatile liquids for use in garages, motor boats, cleaning and tailoring establishments, rubber factories, and other places where gasoline and benzine are used in quantities.

Factory Lighting.

One frame of mounted photographs, illustrating good lighting systems in industrial plants, prepared by the National Lamp Works of the General Electric Company.

Safe Knots, Bends and Hitches.

Two panels upon which are shown properly constructed knots, bends, and hitches in rope used in hoisting work; with descriptive text.

A Collection of Employees' Magazines and Plant Publications.

Representative collection of bulletins and magazines issued by various firms and companies in the interest of their employees, including technical instruction designed to aid them in their work, propaganda for safety and personal hygiene, plant gossip, athletics, and personal news of interest to their families.

Industrial Safety and Health—General

Folding panel upon which will be mounted, upon request, selected blue prints, diagrams, photographs, bulletins, and other material, illustrating common causes of accidents, methods of preventing accidents, shop sanitation, housing plans, recreation and educational facilities, and other measures designed to promote the safety, health and contentment of workers in various lines of industry.

IV. SELECTED BIBLIOGRAPHY OF SAFETY AND ACCIDENT PREVENTION

A bibliography of material suitable for the use of universities in initiating safety work is given herewith. No attempt has been made to include technical matter dealing with special hazards.

1. The General Subject of Safety

BOOKS

Ashe, S. W. Organization in accident prevention. New York, McGraw-Hill, 1917. 130p.

Beyer, D. S. Industrial accident prevention. Boston, Houghton-Mifflin Co., 1916. 421p.

Blanchard, R. H. Liability and compensation insurance. New York, Appleton, 1917. 394p.

Chaney, L. W. & Hanna, H. S. Accidents and accident prevention in machine building. U. S. Bureau of Labor Statistics. Bulletin 216. Washington, 1917. 117p.

Chicago Public Safety Committee. Things you must know for safety. Chicago, Public Safety Committee, 10 So. LaSalle St., 1915. 178p.

Dickinson, S. C. How to organize for safety. University of Arizona. Bureau of Mines. Bulletin No. 81. March 10, 1918. 52p.

Eastman, Crystal. Work accidents and the law. New York, Survey Associates, Inc., 1916. Russell Sage Foundation. The Pittsburgh Survey. 335p.

Holman, D. M. The world movement for industrial safety. Live articles on accident prevention, v. 4, p. 107-119. New York, Weekly Underwriter, 1916.

Lescohier, D. D. Industrial accidents and employers' liability in Minnesota. Being part II of the 12th Biennial Report of the Bureau of Labor, Industries and Commerce of the State of Minnesota, 1909-10. p. 125-324.

Live Articles on Accident Prevention. New York, Weekly Underwriter, 1912-17. 5 vol.

National Safety Council. Proceedings. 1st-6th Congress, 1912-17. Chicago, National Safety Council. 6 vol.

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V. PAMPHLETS AND OTHER PRINTED MATTER THAT CAN BE FURNISHED BY THE NATIONAL SAFETY COUNCIL TO UNIVERSITIES AND TECHNICAL SCHOOLS

Annual National Safety Council Congress Proceedings (1914, 332 pp.; 1915, 771 pp.; 1916, 1541 pp.; 1917, 1549 pp.).

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2. The Ideal Industry from the Standpoint of Health and Safety. Dr. C. G. Farnum, Chief Surgeon, Avery Company, Peoria, Illinois.

3. The Human Side of Industry or the Scope of an Employee's Service Department. Dr. Otto P. Geier, Director, Employees' Service Department, Cincinnati Milling Machine Company, Cincinnati, Ohio.

4. Developments of the Safety Idea. Chancellor S. B. McCormick, University of Pittsburgh, Pittsburgh, Pennsylvania.

5. Organized Accident Prevention. Field Secretary Price of the National Safety Council.

6. Fundamental Principles of Safeguarding. Robert J. Young, Manager of the Safety and Relief Department of the Illinois Steel Company, Chicago, Illinois.

7. How to Organize for Safety. Prepared by the National Safety Council.

8. How to Organize for Safety. Field Secretary, C. W. Price, of the National Safety Council.

9. Safe Practices Pamphlets. National Safety Council.

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Some of the subjects treated in these bulletins are: How to start a safety campaign, How to secure and retain interest in safety, Planning safety inspection work, Workmen's inspection committees, Duties of safety inspectors, Selection of safety committee members, Report forms for shop committees, Safety rule books, Safety bulletin boards, Suggestion boxes, Accident statistics, Books on accident prevention.

VI. A SYLLABUS OF COURSES ON SAFETY

One of the most important things that is to be done today in the safety field is the preparation of detailed syllabi for the various courses. It is the hope of the Committee that something substantial can be accomplished along this line in time for use at the opening of the next school year. Further announcements will be made during the summer.

Attention is called to a course of lectures that has been prepared by the New England Safety Council (a branch of the National Safety Council) for the Massachusetts State Board of Education. This will be ready by September first; it is more fully listed in the bibliography.

VII. SAFE PRACTICES PAMPHLET ON SAFEGUARDING UNIVERSITY SHOPS

It is the present purpose of the Committee to issue a special Safe Practices Bulletin on the safeguarding of university shops. If this should prove unnecessary or impracticable some compendium of references to existing sources will be prepared; in any case something will be ready for distribution at the beginning of the next school year.

VIII. INSPECTION OF UNIVERSITY SHOPS

The National Safety Council volunteers its assistance in securing experts qualified to make safety inspections of university shops. Applications should be made to the General Manager. He will undoubtedly in all cases be able to secure volunteers for this work at no cost to the universities beyond travelling expenses.

IX. MEMBERSHIP IN THE NATIONAL SAFETY COUNCIL AND IN THE AMERICAN MUSEUM OF SAFETY

While the work that has been undertaken by the Safety Education Committee is in no sense a campaign for membership, advantage should be taken of this opportunity, as a matter of interest to the universities, to present the benefits to be had from membership in both the National Safety Council and the American Museum of Safety.

The National Safety Council, Continental & Commercial Bank Building, Chicago, Illinois, founded in 1912, now has over 3,500 members representing at least 5,000,000 workers. Membership in the National Safety Council for technical schools and universities costs $15 per year. The service furnished includes two sets of three shop bulletins and one executive bulletin each week, one Safe Practices pamphlet and one News Letter each month, the lending of films and lantern slides, unlimited use of the information bureau and a copy each year of the Annual Proceedings, last year a book of 1,549 pages. The General Manager will be glad to give further information upon request.

The American Museum of Safety, 14 West 24th Street, New York City, has maintained for a number of years a permanent educational exhibition of approved safety and sanitary appliances. The Museum's resources include an inquiry and research service, lectures and traveling exhibits illustrating various phases of accident prevention and health conservation, as well as a monthly bulletin, "Safety," which is a technical, non-commercial review of approved safety devices and methods, and of the progress of the safety movement. In varying degrees, the services of the Museum are free to members in the following classes: Associate, Active, Commercial and Industrial, the dues ranging from $5.00 to $100.00 per annum.

THE SAFETY ENGINEER*

By L. A. DeBlois

(Safety Engineer, E. I. duPont de Nemours & Company)

Seven years ago the writer, in the interests of reducing the number and severity of the industrial accidents occurring on the plants of the duPont Company, visited the Gary plant of the Illinois Steel Company. The United States Steel Corporation, of which it was a subsidiary, had even then established an enviable reputation for its work in accident prevention. The report of this visit, which is a very painful one for the writer to read, briefly disposed of the subject by stating that accomplishments at Gary could be roughly divided into two classes:—mechanical safeguarding, which was excellent, and safety advertising, which the writer believed was undertaken to convince the general public that the steel industry with a reputation for innumerable serious accidents was not as black as it had been painted.

As I reflect on these earlier impressions and realize that over a year passed before I fully appreciated the injustice I had done the work at Gary, I wonder how many engineers and executives still think today as I thought then—that safety engineering is merely a matter of safeguarding and advertisement. Yet, if I were asked for an opinion I would say without hesitation that the foreman and skilled laborer in our modern industries enjoy a somewhat clearer conception of and entertain a more cordial feeling toward the safety movement than many engineers and executives. It is partly for this reason that I am anxious today to persuade those who have heretofore considered the "safety first" movement as a "fad" or a "frill" that safety engineering is true engineering, that freedom from accident hazards should be a fundamental requisite in the design of structures and machines and a rigid necessity in plant operation and that the greatest obstacle in the path of such attainment exists in a certain apathy to the safety movement among engineers in general and in a very definite and lamentable scarcity of trained safety engineers technically fitted to carry forward the work.

Let us attempt to define the field of the safety engineer's activities. His goal is of course the reduction or elimination of accidents. Analysis of industrial accidents shows that from 15 per cent. to 25 per cent. are unavoidable. In the duPont Company, which I am happy to represent, these cases are those which we attribute to "Risk of Employment," "Unknown Physical Deficiency" and "Act of God" and may be passed by with the brief statement that its number is gradually decreasing as the general knowledge of accident prevention broadens. Of the remainder, or "avoidable" accidents, between 10 per cent. and 20 per cent. are caused by unsafe mechanical or structural conditions and are therefore possible of correction. This leaves 80 per cent. to 90 per cent. attributable to human defects, that is, to the shortcomings of the individual—to ignorance, carelessness, irresponsibility, indifference, disobedience, recklessness, horse-play and inexperience of the injured or fellow-employee—and to defects such as lack of proper supervision, discipline, etc., in the organization.

*A paper read at the spring meeting of the A. S. M. E., Worcester, Mass., June 5, 1918.

Obviously, the safety engineer may not confine his attentions solely to the elimination of those accidents for which his employer or company could be judged responsible under the common law of master and servant—he seeks to eliminate all accidents regardless of responsibility. Each accident is an interruption to output, a needless expense, a cause of suffering, and a drain on the resources of the community and of the country at large. In 1916 there were approximately 22,000 persons killed in industrial accidents in this country alone and 500,000 injured to the extent of losing over four weeks from work. Such wastage of man-power and production is in the aggregate enormous and constitutes a monetary loss of serious proportions. Unfortunately, its dollars-and-cents equivalent cannot be readily estimated. Workmen's compensation acts, which have largely rendered unnecessary recourse to suits at common law, practically ignore the question of relative responsibility and place approximately one-half the burden of accident compensation for all accidents on the shoulders of the employer. In establishing a rate of compensation, however, these acts make no attempt to evaluate life and limb but, based somewhat on the average net judgments for damages in suits at common law, aim rather to fix on the industries a fair proportion of the financial burden. It is not reasonable, therefore, to assume that the cost of accidents to the people of any state is represented by the total annual payments for compensation. Losses incident to injury or death are in one sense no more compensatable than losses by fire are "covered" by insurance. In both cases there has been withdrawn from the nation's reservoir man-power, or property representing man-power, which can never be replaced.

A remarkable thing about the preceding analysis of industrial accidents is that it seems to apply equally well to any industry. The duPont Company, for instance, which is engaged in the manufacture of the most dangerous materials used in both industry and war—explosives, ammunition and strong acids—discovers about the same assignment of responsibility for accidents as does the cement industry. Mining, railroads, and other industries have the same experience. Moreover, the non-fatal and fatal accident rate on the duPont Company's plants does not itself differ greatly from the rates of other and so-called "non-hazardous" industries. Both premises lead us directly to the logical, though somewhat surprising, conclusion that neither the nature of the industry nor the character of the materials produced or handled has as much effect on the cause, frequency and severity of accidents as the safe design and equipment of plants, the provision of a proper organization and constant supervision and the education of the working force into habits of caution and careful practices.

Have we not in this way defined the field of the safety engineer's activities and accredited him to all the provinces of design, equipment, organization, supervision and education? His influence must surely spread into each of them if consistent accident prevention is to be attained. But in reality they cover practically the whole vast territory of industrial projection, construction and operation.

There may be some who would at first object radically to the intrusion of the safety engineer's ideas into all these matters, especially since, as the exponent of "safety first," he is sometimes accused of interference with production. Let us examine it from the practical side. In the design of structures no engineer neglects the "safety factor"—it has become one of

the tools of his trade—but who has not encountered stairs poorly designed, or probably not designed at all—left to the experience of the carpenter—the hand-rails of which, put there for emergency, must be used continuously if an accident is to be avoided? We are all acquainted with new plants where aisles are dangerously narrow, where there is insufficient head-room, where machinery is inaccessible for repairs and valves for manipulation or repacking. The safety engineer who sees these conditions and recognizes that accidents will inevitably occur may be met with the objection that they have not yet caused accidents and that expensive alterations are not justified and would hold up operations. These matters could have been corrected at less expense in the original design and probably would have been, had anyone with experience considered them from this angle.

As for equipment there are types of machine tools that are dangerous and others that are less so and equally efficient—the cylindrical head jointer, for instance—and there is machinery that could have been better safeguarded by the manufacturer if complete guarding had been specified or if the pressure of demand by the trade had forced him to recognize that he must supply adequate guards or suffer through unequal competition.

In the field of general mechanical safeguarding there has been marked progress in recent years and some excellent "standards" have been formulated, among them those of the A. S. M. E. But the more difficult problems encountered are those arising from local application and arrangement of machinery, often peculiar to the industry in question, and others due to conditions abnormal to regular operation. As a fundamental, we may as well admit that no machinery can be made "fool-proof" in its regular operation and we must furthermore admit that conditions occur during adjustment, oiling, cleaning, repairs, replacement, etc., under which "standard" safeguards may be useless or even introduce hazard. Evidently the solution of the problem of how to make the equipment as safe as possible under all conditions cannot be reached through mere general acquaintance with machinery of the class in question, nor by a casual inspection of the plant in normal operation—it will yield only to analysis after a painstaking study of all phases of operation and of conditions such as poor lighting, inaccessibility and congestion which are contributory to accident.

I have already stated that the majority of accidents are due to the shortcomings of human nature, to personal tendencies and traits in the individuals liable to injury and to deficiencies in the organization which employs, instructs, holds in restraint and disciplines them. Here the safety engineer is upon different ground and must employ his knowledge of psychology and the principles of industrial organization. Diplomacy, perseverance and tact will be his greatest aides—and patience at the slow response to his insistent efforts to change the mental viewpoint. But there is in this branch of the work a principle so important that its neglect will bring failure in place of success. It is a clear recognition of the fact that the safety engineer can no more effect general accident reduction by his own direct efforts alone than the doctor can by curing the sick make a healthy community.

Perhaps a brief consideration of this point will be illuminating. In any process there are thousands of combinations of circumstances which

will produce accidents—many more than can be foreseen or anticipated by the issuance of specific instructions. Through general education we may awaken a sense of personal responsibility in the man and emphasize that it is necessary to "be careful," but this injunction is of little value if the actual presence of danger is not realized. Failing these, we must rely on the detection of dangerous practices among the men. The safety inspector or safety engineer should be able to tell if a certain practice is dangerous when he sees it, but he cannot watch all the practices of a thousand working men or even a hundred. The one class of men who can perform this function most efficiently is the foremen, but someone must instruct the foremen as to what is dangerous. This is the function of the safety engineer or inspector. However, an executive authority immediately above the foremen must first convince him and continue to convince him that he is required to properly supervise for safety. The plant manager must place himself clearly on record to the effect that safety is as important in the day's work as production or quality, for it is from him that the organization takes its tone. From the directing officials of the company must come moral and financial support. Thus the whole organization is involved. All must "work for safety" with the safety engineer in the position of technical adviser and the source of the inspiration that is necessary to an enthusiastic promotion of the work.

I trust that in the foregoing I have shown you that safety engineering with its interests in design, equipment, organization, supervision and education should have a place in every field of industrial enterprise and that it bears as well a very definite and important relation to all other branches of engineering. This relation is so close and its need so urgent that I am convinced that some instruction in the fundamentals of safety engineering should be given a place in the training of every young engineer. He should be taught to think in terms of safety as he now thinks in terms of efficiency. Conservation of life should surely not be rated below the conservation of energy. Yet few of our technical schools and universities offer instructions in this subject and the graduates go out to their profession with only vague surmises on "what all this talk on safety is about." Shall we leave it to them to learn that pioneering, where hazards must be accepted, is not synonymous with progress, where life and manpower must be conserved?

Theoretically any large organization should recognize the necessity for intelligent safety engineering and seek a competent safety engineer, but in many instances in the past the history of the case has been reversed —the doctor has sought the patient and convinced him that he was sick. "Old-fashioned" doctors, "common sense" doctors and "practical" doctors were once in vogue and enjoyed large practices but today we recognize the value and necessity of technical training in most professions. Yet in that of safety engineering a great weakness exists. We have "safety inspectors" by the hundred, but scarce, indeed, are safety engineers, technically trained and experienced men who are capable of studying an industry or process from all its angles and of making constructive recommendations for changes in design and operation which strike to the root of the unnecessary accident evil. Today, at the time of writing, the supply is practically exhausted and there are well paid positions open for

them in Government Arsenals and Navy Yards, in the Emergency Fleet Corporation and in many of the larger industries.

I do not wish to be understood as underrating the safety inspector. There are many among them who are successfully filling worthy and responsible positions. There are many more who bear about the same relation to the safety engineer as the "stationary engineer" does to the mechanical engineer. Many are capable of making thorough inspections and recommending standard safeguards but are debarred by personal limitations from going very much further. Yet on many plants nothing further is demanded. "We have a Safety Inspector and a Safety Committee"—the Safety Inspector is of the "practical" type and the Safety Committee is recruited from men in the shop who by some strange metamorphosis are expected to become suddenly expert in detecting hazards previously unrecognized. The real truth of the matter is that the Safety Committee proves very useful in detecting obvious conditions that the foremen and management ought to have observed and had remedied long ago, though quite incidentally the experience gained by the committeemen is good for them and opens their eyes to many common hazards. As for the "practical" inspector, he is useful and may be valuable, but he is in no sense an engineer.

The National Safety Council is the representative organization of the country dealing with safety. Since its foundation in 1912, its activities have extended until its membership now represents the employers of over 6,000,000 men. The safety of this vast army of workers should be in the hands of trained men but there are few to fill the vacancies that exist today and the new positions that will be created tomorrow. It is not right that the onward march of the safety movement should be halted to permit its officers to be recruited and trained.

If there was ever need for a national campaign to reduce death and disablement from industrial accidents that need is today. They tell us that at least three workers are necessary at home to supply one man at the front. By workers is meant producers—not hospital patients—and the war will bring us enough reconstruction problems in the employment of war cripples and returned soldiers without the problem of employing the many men crippled in our industries. Let us realize then that "safety" is not child's play, not a matter for "practical" men, not a passing "fad," but real work for real engineers and that the sooner we accept this viewpoint and shed our coats to the undertaking the less cause shall we have, when light comes, to regret the days of complacent inaction.

Wilmington, Del., May 15, 1918.

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